

REMARKS

Claims 1 and 2 are pending in the above identified application. It is respectfully submitted that this paper is fully responsive to the Office action mailed on August 13, 2010.

Claim Rejections - 35 U.S.C. §103

Claims 1 and 2 stand rejected under 35 U.S.C. §103(a) as being unpatentable over U.S. Patent No. 6,086,261 to *Nakagawa et al.*

Applicants respectfully disagree with the Office Action's characterization of the cited reference and pending claim language. Applicants request favorable reconsideration of claims 1 and 2 in view of the following remarks.

First, *Nakagawa et al.* does not disclose a technical idea to define particular ranges of the total crowning amount and the crowning amount ratios of the outer ring, tapered roller and inner ring to the total crowning amount so as to achieve advantageous effects and unexpected results. Therefore, it cannot be predicted by *Nakagawa* that the effect of rotation torque reduction is obtained in the specific ranges of the total crowning amount and the crowning amounts of inner and outer rings and tapered roller as indicated in Figs. 6-8 of the present application.

Nakagawa discloses that the tapered rollers are axially moved to be pressed against the cone back face rib face of the inner ring for allowing the tapered rollers to settle in their normal positions (col. 11, lines 54-58). When the tapered roller contacts the cone back face rib face in this manner, the rolling friction between the tapered roller and the internal ring increases as a matter of course, resulting in the increase of the rotation torque of the tapered roller bearing.

This leads to a completely opposite effect to that of the present invention intending to decrease the rotation torque of a tapered roller bearing. As described above, *Nakagawa* clearly involves a negative result for the objective of the present invention. Therefore, it is unreasonable to cite *Nakagawa* as a basis for rejecting the pending claims.

Second, it would not have been obvious to modify *Nakagawa et al.*, such that the total crowning amount, defined as the sum of crowning amount of outer ring 1, the crowning amount of inner ring 2 and two times the crowning amount of the roller 3 times, is more than 50 μm , and the crowning ratio of the outer ring 1, defined as crowning amount of outer ring 1 divided by the total crowning amount, is 40% or more, and the roller 3 crowning ratio, defined as two times the roller 3 crowning amount divided by the total crowning amount, is 20% or less, "since it has been held that discovering optimum value of a result effective variable involves only routine skill in the art." Office Action, page 3.

"The law is replete with cases in which the difference between the claimed invention and the prior art is some range or other variable within the claims. . . . In such a situation, the applicant must show that the particular range is critical, generally by showing that the claimed range achieves unexpected results relative to the prior art range." *In re Woodruff*, 919 F.2d 1575 (Fed. Cir. 1990).

Applicants submit that Figs. 6-9 show, for example, the criticality of the claimed range. The inventors conducted verification test(s) (results in Figs. 6-9) to clarify the relationship between the rotational torque of the tapered roller bearing, the total crowning amount, and each crowning ratio. Many different tapered roller bearings were prepared, in which the total

crowning amount and each crowning ratio were set to various values, to experimentally measure the resultant rotation torque. **The test confirmed that the rotation torque of the tapered roller bearing decreases** provided that the total crowning amount is 50 μm or more, the outer ring crowning ratio is 40% or more, and the roller crowning ratio is 20% or less.

Whereas, *Nakagawa's* roller crowning ratio is greater than 20%. As shown in the scatter graph illustrated in Fig. 8, when the roller crowning ratio is 20% or less (claimed range), the torque ratio stably scatters in a lower-value range in comparison with the case where the roller crowning ratio is more than 20% (*Nakagawa's* ratio is 23.1%). See paragraph [0031].

Also, *Nakagawa's* outer ring crowning ratio is less than 40%. As shown in the scatter graph illustrated in Fig. 9, when the outer ring crowning ratio is 40% or more, the torque ratio stably scatters in a lower-value range compared with the case in which the outer ring crowning ratio is less than 40% (*Nakagawa's* ratio is 38.5%). See paragraph [0030].

Nakagawa does not recognize that satisfying the claimed ranges reduces the rotational torque of the tapered roller bearing. Instead, *Nakagawa* only mentions that arrangement described in the specification and recited partly above (*e.g.*, col. 13, lines 9-13) "ensures smooth axial movement of the tapered roller 3 toward the cone back face rib face 2c during the running-in operation and shortens the running-in operation time." See Col. 13, lines 13-17.

Thus, the particular claimed ranges are critical and achieve unexpected results relative to the *Nakagawa et al.* range

Accordingly, for at least the reasons discussed above, Applicants respectfully submit that a *prima facie* case of obviousness has not been presented in this Office Action.

Conclusion

In view of the aforementioned amendments and accompanying remarks, Applicants submit that the claims, as herein amended, are in condition for allowance. Applicants request such action at an early date.

If the Examiner believes that this application is not now in condition for allowance, the Examiner is requested to contact Applicants' undersigned attorney to arrange for an interview to expedite the disposition of this case.

If this paper is not timely filed, Applicants respectfully petition for an appropriate extension of time. The fees for such an extension or any other fees that may be due with respect to this paper may be charged to Deposit Account No. 50-2866.

Respectfully submitted,
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